Working paper summary

Dynamic implied correlation modelling and forecasting in structured finance

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Correlations are the main drivers of credit portfolio risk. Furthermore, they constitute a major element in pricing credit derivatives such as synthetic single-tranche collateralised debt obligation swaps.

This paper highlights the merits of a dynamic panel regression approach to modelling and forecasting implied correlations.

Over the past twenty years, the traded volume of credit derivatives has grown rapidly, highlighting their financial market importance.

However, the global financial crisis (GFC) brought to light a particular challenge in the pricing of credit derivatives, such as collateralised debt obligations (CDOs). Specifically, it became evident that creating tranches within CDO structures may have amplified potential errors in the assessment of default risks associated with the underlying assets, and the correlations between these risks.

In general, credit risks, and the correlations between them, determine the loss distribution of credit portfolios' underlying derivatives. However, correlation measures are not readily observable, and therefore they are unknown parameters. This underlines the need for appropriate correlation models in order to estimate expected tranche losses, which in turn determine tranche prices or spreads. Accordingly, appropriate correlation forecasts are important parameters in the pricing models of structured financial instruments.

There are several standard approaches to estimate implied correlations matching observable market spreads of credit derivatives. Analogous to extracting implied volatilities from option market prices using the Black-Scholes equation, implied correlations can be extracted from CDO tranche prices.

This study examines three correlation estimation approaches in the context of their forecasting performance.

1. Base correlations are derived from tranche spreads on the iTraxx Europe Index.
2. Base correlations are modelled using:
    - A dynamic fixed effects regression correlation model (FERM); and
    - A dynamic mixed effects regression correlation model (MERM).
3. These correlations are used to calculate daily spread forecasts, and, in turn, forecast errors.

A FERM accounts only for fixed tranche-specific effects, whereas a MERM additionally reflects the variability impact of time.

A comparison of the forecast performances of the respective models shows that the implied correlation models are superior to a dynamic historical asset correlation approach in terms of prediction errors. The results correspond to findings related to option markets, where implied volatility regression models outperform forecasts based on standard deviations of log-returns.

The forecast accuracy of the models is measured by calculating the root mean square forecast error (RMSFE) of STCDO spreads. Analogously, daily STCDO spreads are forecast with a dynamic asset correlation model (ACM). A comparison of the forecast accuracy suggests the superiority of the dynamic regression correlation models in terms of the RMSFE metric.

The increased accuracy of the MERM leads to an improvement of the overall spread forecast performance with several implications for financial institutions and regulatory authorities dealing with structured finance instruments.

The intra-class correlation indicates the existence of unconsidered systematic risk varying over time, and underlines the importance of applying a MERM in order to account for such systemic time effects.

By expanding the MERM to other relevant systemic risk factors, useful information can be derived in order to develop appropriate stress tests for structured finance products. It may also support the measurement of risk contributions of synthetic STCDOs to inherent portfolio credit risks, which is particularly relevant for investors in securitised tranches.